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## Research Interests

Physical & computational oceanography, North Atlantic-Arctic connectivity, Ice-ocean interactions, Ocean observing system design, Inverse and adjoint modeling, Uncertainty quantification

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## Education

- 01/2015 - **University of Bergen**, Bergen, Norway.
- 08/2019 **Ph.D. in Physical Oceanography**
  - Thesis: *Adjoint Modeling and Observing System Design in the Subpolar North Atlantic*
  - Funded by European Research Council project [ice2ice](#)
- 04/2007 - **University of Bonn**, Bonn, Germany.
- 02/2013 **Diploma** (equiv. M.Sc. degree) in **Mathematics, with Honors**
  - Specialization: Stochastic Analysis; Minor: Physics
  - Grade Point Average: 1.0, on a scale from 1.0 (excellent) to 4.0 (pass)

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## Research Experience

- 10/2018 - **Research Fellow**, *Oden Institute for Computational Engineering and Sciences*, University of Texas at Austin.
  - Develop quantitative and physics-informed methods for ocean observing system design
  - Mentor: Patrick Heimbach
- 1/2015 - **Graduate Researcher**, *Department of Earth Science*, University of Bergen, Norway.
- 06/2018
  - Investigated oceanic teleconnections in the North Atlantic, Nordic Seas, and Arctic Ocean
  - Quantified uncertainties in ocean state estimates for present-day and paleoclimates
  - Advisors: Kerim H. Nisancioglu (University of Bergen), Patrick Heimbach (UT Austin)
- 03/2013 - **Doctoral Research Fellow**, *Department of Mathematics*, ETH Zurich, Switzerland.
- 08/2014
  - Conducted research in the fields of Geometric Analysis and Partial Differential Equations
  - Assisted in teaching undergraduate and graduate level courses

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## Teaching and Outreach

- 02/2020 **Volunteer**, *Girl Day STEM Festival*, UT Austin.
  - Hands-on science activities and demonstrations for elementary and middle school students
- 03/2013 - **Teaching Assistant**, *Department of Mathematics*, ETH Zurich, Switzerland.
- 08/2014
  - Taught 3 graduate level math courses (*Measure Theory & Integrals*, *Differential Geometry I, II*)
  - *Teaching evaluations*: 4.8 (2013), 4.9 (2014) on a scale from 1 (very bad) to 5 (excellent)
- 07/2013 **Teaching Assistant**, *PCMI Graduate Summer School*, Park City, UT.
  - Taught advanced math course (*Weak immersions of surfaces with  $L^2$ -bounded second fundamental form*, [lecture notes](#)) for Ph.D. students and postdocs
- 10/2008 - **Teaching Assistant**, *Department of Mathematics*, University of Bonn, Germany.
- 02/2013
  - Taught 3 undergraduate level math courses (*Mathematics for Physicists I, Analysis II, III*)
- 01/2010 - **Teaching Assistant**, *Department of Mathematics*, University of Toronto, Canada.
- 04/2010
  - Taught undergraduate level math course (*Linear Algebra*)
- 2009 - 2011 **Student Assistant**, *Hausdorff Center for Mathematics*, University of Bonn, Germany.
  - Organized and led math outreach events for students from elementary and secondary school

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## Professional Service

### Organization of Conferences

- 04/2017 Co-Convener for the session "Quaternary climate archives and proxy uncertainty", EGU General Assembly 2017.
- 09/2015 Co-Organizer of PhD conference "Connecting the ocean, atmosphere and ice sheets", 20 participants, Denmark.

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## Awards and Scholarships

- 04/2019 **Rising Stars in Computational & Data Sciences**, *Oden Institute for Computational Engineering and Sciences*, University of Texas at Austin.
  - Selected for competitive, international career event for women in Computational & Data Sciences
- 03/2018 **Best Presentation Award**, *Research School on Changing Climates in the Coupled Earth System*, Sommarøy, Norway.
- 02/2016 **Research Grant**, *Norwegian Research School in Climate Dynamics*, NOK 20,000, for research stay at MIT.
- 2013 - 2016 **Scholarships for various summer schools.**
  - IARC Summer School 2016, *University of Fairbanks*
  - ACDC Summer School 2015, *Norwegian Research School in Climate Dynamics*
  - New Directions Short Course IMA 2015, *University of Minnesota*
  - PCMI Summer School 2013, *Institute for Advanced Study, Princeton*
- 02/2013 **Award "Diploma with Honors"**, *Department of Mathematics, University of Bonn, Germany*, for graduating with highest possible grade point average.
- 2009/10 **Scholarship for Study Abroad Program (University of Toronto)**, *University of Bonn*.
- 2008 - 2012 **German Academic Scholarship Foundation Award**, *Studienstiftung des deutschen Volkes*, for outstanding academic achievements (given to 0.5% of students in Germany).
- 2006 **3 Awards**, for exceptional results in high-school final exams on state-wide basis.
  - *Porsche AG*: for excellent performance in mathematics and physics
  - *German Physical Society*: for excellent performance in physics
  - *Reinhold Beitlich Foundation*: for exceptional overall performance

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## Publications

### Journal Articles

- J1 Y. Fujii, E. Rémy, H. Zuo, P. Oke, G. Halliwell, F. Gasparin, M. Benkiran, **N. Loose**, J. Cummings, J. Xie, Y. Xue, S. Masuda, G.C. Smith, M. Balmaseda, C. Germaineaud, D.J. Lea, G. Larnicol, L. Bertino, A. Bonaduce, P. Brasseur, C. Donlon, P. Heimbach, Y. Kim, V. Kourafalou, P-Y. Le Traon, M. Martin, S. Paturi, B. Tranchant and N. Usui. Observing System Evaluation Based on Ocean Data Assimilation and Prediction Systems: On-Going Challenges and a Future Vision for Designing and Supporting Ocean Observational Networks, *Front. Mar. Sci.* 6:417, 2019. doi: [10.3389/fmars.2019.00417](https://doi.org/10.3389/fmars.2019.00417).

### Preprints

- P1 **N. Loose**, P. Heimbach, H. Pillar and K.H. Nisancioglu. Quantifying Dynamical Proxy Potential through Oceanic Teleconnections in the North Atlantic. Preprint: doi: [10.1002/es-soar.10502065.1](https://doi.org/10.1002/es-soar.10502065.1)

## In Preparation

- P2 **N. Loose** and P. Heimbach. Physics-driven Design of Observing Systems via Uncertainty Quantification in Ocean State Estimation, *planned submission: April 2020*
- P3 **N. Loose**, P. Heimbach, H. Pillar and K.H. Nisancioglu. The Dynamical Proxy Potential of the OSNAP Array, *planned submission: May 2020*
- P4 **N. Loose**, H. Pillar, M. Årthun, K.H. Nisancioglu and P. Heimbach. Remote Drivers of Nordic Seas Heat Content Anomalies and Climate Predictability, *in prep.*
- P5 **N. Loose**, K.H. Nisancioglu and P. Heimbach. Ocean Heat Supply to Greenland's Margins: Sensitivity to far field ocean changes, *in prep.*

## Thesis

- T1 **N. Loose**. Adjoint Modeling and Observing System Design in the Subpolar North Atlantic, *Ph.D. Dissertation*, University of Bergen, 2019

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## Presentations

### Invited Talks

- 03/2020 **SIAM Conference on Uncertainty Quantification**, *Munich, Germany*.  
(conference cancelled due to COVID-19)
- 02/2020 **Ocean Sciences Meeting 2020**, *San Diego, CA*.  
The Dynamical Proxy Potential of the OSNAP Array
- 04/2018 **EGU General Assembly 2018 (solicited)**, *Vienna, Austria*.  
How informative are SST proxy data in paleoceanographic inverse modeling?
- 03/2018 **University of Edinburgh**, *Edinburgh, UK*.  
Uncertainty Quantification and Constraints on Subsurface Heat Content at Greenland's Margins
- 03/2018 **Northumbria University**, *Newcastle, UK*.  
Uncertainty Quantification and Constraints on Subsurface Heat Content at Greenland's Margins

### Selected Conference Presentations

- 10/2018 **ECCO Meeting**, *Austin, TX*.  
Comprehensive Observing System Design within the ECCO Framework
- 07/2018 **Workshop on Sensitivity Analysis and Data Assimilation in Meteorology and Oceanography**, *Aveiro, Portugal*.  
Uncertainty Quantification as a Tool for Observing System Design - An Oceanographic Perspective
- 06/2018 **Adjoint (TACOMA) Workshop**, *Oxford, UK*.  
Adjoints as a Tool for Observing System Design

### Posters

- 06/2017 **Data Assimilation Workshop**, *Bergen, Norway*.  
How Informative are Paleoceanographic Observations for an Inverse Problem?
- 05/2017 **Past Global Changes (PAGES) Workshop**, *Louvain-la-Neuve, Belgium*.  
How Informative are Paleoceanographic Observations for an Inverse Problem?
- 04/2017 **EGU General Assembly 2017**, *Vienna, Austria*.  
Uncertainty Quantification for Non-Linear Inverse Problems with Sparse Data
- 03/2017 **Workshop on Emerging Applications of Data Assimilation in the Geosciences**, *Leiden, Netherlands*.  
Uncertainty Quantification for Adjoint-Based Data Assimilation with Sparse Data

- 12/2016 **AGU Fall Meeting 2016**, *San Francisco, CA*.  
Can Paleo Ocean Proxy Data Constrain General Circulation Models Using an Inverse Method?

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## Selected Courses

### Oceanography & Modeling

- Fall 2016 **Introduction to Ocean Modeling**, *Instructor: Patrick Heimbach*, UT Austin, TX.  
Conservations laws, approximations, discretization, parameterization schemes, adjoint modeling.
- 02/2016 **Large Scale Turbulence in Atmosphere and Ocean**, *Instructor: Joe Lacasce*, University of Oslo, Norway.  
2D turbulence, 3D turbulence, geostrophic turbulence, turbulent diffusion.
- 11/2015 **HPC Course**, University of Bergen, Norway.  
High-Performance Computing (HPC), MPI and OpenMP programming, build systems, revision systems, debugging.
- Spring 2015 **Numerical Modeling**, University of Bergen, Norway.  
Finite difference methods, explicit and implicit schemes, staggered grids and time steps, stability analyses, relaxation methods for boundary value problems, flux limiter and TVD schemes.

### Data Assimilation & Uncertainty Quantification

- Fall 2017 **Computational methods for inverse problems**, *Instructor: Omar Ghattas*, UT Austin, TX.  
Theory and numerical solution of PDE-constrained inverse problems.
- 06/2017 **Crash Course on Data Assimilation - Theoretical foundations and advanced applications with focus on ensemble methods**, NERSC, Bergen, Norway.  
EnKF, data assimilation for climate prediction and chaotic dynamics, model error, particle filters.
- 06/2015 **Introduction to Uncertainty Quantification**, *Instructors: Youssef Marzouk, Luis Tenorio*, Institute for Mathematics and its Applications, University of Minnesota, MN.  
Bayesian statistics, uncertainty quantification, model validation, model reduction, MCMC methods.

### Mathematics

- 2009 **Stochastic Processes**, University of Bonn, Germany.  
Gaussian processes, Markov processes, Gibbs measures, Random walks, Brownian motion.
- 2010/11 **Stochastic Analysis**, University of Bonn, Germany.  
Martingales, Stochastic integrations, Ito calculus, Stochastic differential equations.

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## Field Work

- 07/2017 - **East Greenland Ice-Core Project ([EastGRIP](#))**, *Greenland*.  
08/2017 ◦ Drilled shallow ice cores, conducted surface measurements and lab work in the science trench
- 08/2016 - **G.O. Sars**, *Irminger Sea*.  
09/2016 ◦ Collected physical oceanographic data and marine sediment cores for the [ice2ice](#) project (ERC)

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## Skills

### Programming

- Python, MATLAB, Fortran, Unix/Linux, Git,  $\text{\LaTeX}$ .

### Languages

- *Fluent in:* German, English, Norwegian; *Basic knowledge in:* Spanish, Italian.